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Auxin Concentration and Cutting Submersion Duration Impact Survivability and Root Response of Florida Azalea

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Abstract

Florida azalea (*Rhododendron austrinum)* is a deciduous azalea native to northern Florida, coastal Alabama, southern Georgia, and southeastern Mississippi. To provide growers with relevant cutting propagation recommendations, the objective of this research was to determine optimal commercial auxin concentration and submersion timing on softwood stem cuttings. The auxin used was Hortus IBA Water Soluble Salts™ (Hortus IBA) at 0, 1000, 2500, 5000, 7500, or 10000 ppm IBA. Submersion durations were 0, 1, 6, 12, or 24 hours with 0 receiving a 5-sec basal quick-dip. Duration of submersion effected root percentage (P<.0001), number of roots (P=0.01), and average length of the three longest roots (P=0.04). There was an interaction between auxin concentration and submersion duration for root quality (P=0.006), cutting quality (P<.0001) and growth indices (P<.0001). Results indicate that softwood Florida azalea cuttings had a better rooting response when treated with a 5-sec basal quick-dip and auxin concentration was 2500.

INTRODUCTION

Deciduous azaleas are described by Dirr (2017) as being "among the most common woody flowering shrubs in the United States, with a myriad of shapes, sizes and flower colors". Although native to many areas of the world, 15 species are native to the Eastern United States (Dirr and Heuser, 2018; Hyatt, 2006). Florida azalea, (*Rhododendron austrinum* (Small) Rehder*)* was discovered by A. W. Chapman before 1865 and reported as a distinct species by John K. Small in 1913 (Galle 1967). Flowers are fragrant and range from pale yellow to orange in color with clusters of 8 to 15 blooms appearing in early spring and generally preceding or coinciding with emergence of dark green leaves that turn a yellow to bronze-orange color in the fall (Dirr, 2017; Hyatt, 2006,). Native range is across northern Florida, coastal Alabama, southern Georgia and southeastern Mississippi (USDA Hardiness zones 6b-10a) (Knight et al., 2005).

Propagation of native deciduous azaleas can be done by seed, cutting, and layering. Due to variability in seed grown azaleas, cutting propagation is preferred (Hyatt, 2006; Sommerville, 1998). However, deciduous azaleas are considered to be a difficult-to-root plant species. According to Dirr and Heuser (2006), slightly firm, 15.2 cm (6 in.) cuttings should be taken from the beginning to end of April. They recommend using a fungicide with 4000 ppm IBA; however, recommended auxin concentrations can vary with different cultivars. Hyatt (2006) recommends taking 5 to 8 cm (2 to 3 inch), softwood cuttings in late May to early June while the plants are actively growing. Bir (1992) took softwood cuttings after the new growth had ceased and treated with 1000-2500 ppm IBA.

Florida azalea has been reported to be easy to propagate according to Galle (1987) and Skinner (1961). Treatment of Florida azalea softwood cuttings with 10000 ppm K-IBA resulted in successful rooting (Knight et al. 2005). Rooting with lower rates of K-IBA occurred, however higher rates increased root number, length, and quality. Knight et al. (2001) also observed that while root ratings, lengths and numbers were similar for cuttings treated with 8000 ppm and 10000 ppm K-IBA, cuttings receiving 10000 ppm rooted 100%.

Developed in the 1940's, long soak immersions have been useful for some hard to root species (Doran 1957, Kroin 2016). Kroin (2016) states that long soak immersions are used to "improve the rooting of hard to root cuttings". Skinner (1937) applied a basal soak treatment from 8 to 48 hours on 45 different plants in the *Ericaceae* L. family, including *Rhododendron* L. Skinner (1937) observed that "some plants rooted satisfactorily without auxin treatment, but most exhibited an increase in average rooting over nontreated cuttings".

The objective of this study was to determine if different submersion durations across a range of IBA concentrations improves rooting response on very soft cuttings of Florida azalea.

MATERIALS AND METHODS

A completely randomized experimental design was utilized with five cuttings per treatment. Florida azalea cuttings were taken on 19 April 2019 from a native population at Crosby Arboretum in Picayune, MS (USDA zone 8b). Cuttings were taken around 6:30 am after a recent rain to ensure they were turgid to aid in reduction of transpiration stress on the cuttings. Using the method that was described by Jenkins (2007), cuttings were taken from tissue soft enough

to be removed via pinching. This resulted in variable cutting sizes, however the average length of the cuttings was around 5 cm (2 in.) long. Immediately after pinching, cuttings were placed and stored in a cooler of water until being stuck in the respective treatments (Jenkins 2007). At sticking, cuttings were turgid and showed no signs of wilting or stress.

Based on previous studies, Hortus (Hortus IBA Water Soluble Salts™) was chosen as the auxin. IBA rates were 0, 1000, 2500, 5000, 7500, or 10000 ppm. Submersion durations were 0, 1, 6, 12, or 24 hours with 0 receiving a 5-sec basal quick-dip. Cuttings were wounded then submerged for each time interval, removed, and stuck into 100% perlite substrate in a 6.4 cm (2.5 in.) container. They were then placed under intermitted mist for 4 seconds every 6 minutes during daylight hours. Sixty days after sticking, it was noted that most all cuttings had callused, but formed no roots. At this time, mist intervals were reduced to 2 seconds every 10 minutes and a liquid application of 20-10-20 (Peters® Professional, J.R. Peters, Allentown, PA, USA) general purpose fertilizer at the rate of 50 ppm nitrogen was applied to try and encourage root growth.

Data collected after 120 days included rooting percentage, growth index (new shoots), cutting quality (1-5, with 1=dead and 5=transplant-ready cutting), total root number, average root length (of three longest roots), and root quality (1-5, with 1=no roots and 5=healthy, vigorous root system). Data were analyzed by JMP 14.1.0 Student Edition (SAS Institute, Inc., Cary, NC, USA). All parameters were analyzed by two-way mixed effects ANOVA using standard least squares.

RESULTS

There was an interaction between auxin concentration and submersion duration for root quality (P=0.0056), cutting quality (P<.0001) and growth indices (P<.0001). (Table 1). The 0-hour submersion (5-second quick-dip) resulted in higher cutting and root quality when compared to longer submersion durations. Hortus at a rates of 1000, 2500 or 7500 ppm IBA showed a higher cutting quality when applied at 0-hour submersion duration compared to IBA rates of 2500, 5000, 7500, or 10000 ppm applied at the 6, 12, or 24-hour submersion durations. Root quality was increased when 2500 ppm IBA was applied at the 0-hour submersion duration in comparison to IBA rates of 0, 1000, 2500, 5000, 7500, or 10000 ppm applied at 1, 6, 12, or 24-hour submersion durations. Growth indices also increased when 2500 ppm IBA was applied at the 1-hour immersion timing compared to IBA rates of 1000, 2500, 5000, 7500, or 10000 ppm applied at the 6, 12, or 24-hour immersion timings.

Root percentage (P<.0001), number of roots (P=0.0101), and average length of the three longest roots (P=0.0415) responded negatively to immersion duration treatments except for average length of the three longest roots for cuttings submerged for 6 hours. (Table 2). For all three parameters, the 0-hour immersion timing resulted in better cuttings compared to the other four timing treatments. Auxin rate did not have an effect on these three data parameters.

Table 1. Influence of auxin concentration and immersion duration and on root quality, cutting quality, and growth of Florida azalea.

Treatment	Root quality rating[y]	Cutting quality rating[x]	Growth index[w]
0 hr Immersion Control	1.5def[v]	3.2ab	4.6abc
0 hr Immersion Hortus 1000 ppm	1.6cde	3.6a	5.4ab
0 hr Immersion Hortus 2500 ppm	2.3a	3.6a	4.2abc
0 hr Immersion Hortus 5000 ppm	2.2ab	2.8bc	4.5abc
0 hr Immersion Hortus 7500 ppm	1.7bcde	3.6a	5.4ab
0 hr Immersion Hortus 10 000 ppm	1.6cde	3ab	5abc
1 hr Immersion Control	1.5def	3.2ab	5.3ab
1 hr Immersion Hortus 1000 ppm	1.5def	3.2ab	5.2abc
1 hr Immersion Hortus 2500 ppm	1.5def	3ab	5.7a
1 hr Immersion Hortus 5000 ppm	1.5def	3ab	5.1abc
1 hr Immersion Hortus 7500 ppm	1.4def	2.6bcd	3.8cd
1 hr Immersion Hortus 10 000 ppm	1f	1.4fg	0.8fg
6 hr Immersion Control	1.5def	2.6bcd	4.8abc
6 hr Immersion Hortus 1000 ppm	2.1abc	2.6bcd	4.3abc
6 hr Immersion Hortus 2500 ppm	1.3def	2.8bc	4.2bcd
6 hr Immersion Hortus 5000 ppm	1f	1g	0.0g
6 hr Immersion Hortus 7500 ppm	1f	1g	0.0g
6 hr Immersion Hortus 10 000 ppm	1f	1g	0.0g
12 hr Immersion Control	1.8abcd	3.2ab	5.5ab
12 hr Immersion Hortus 1000 ppm	1.6cde	2.8bc	4.2bc
12 hr Immersion Hortus 2500 ppm	1.2ef	1.8ef	1.9ef
12 hr Immersion Hortus 5000 ppm	1f	1g	0.0g
12 hr Immersion Hortus 7500 ppm	1f	1g	0.0g
12 hr Immersion Hortus 10 000 ppm	1f	1g	0.0g
24 hr Immersion Control	1.3def	2.2cde	2.7de
24 hr Immersion Hortus 1000 ppm	1.3def	2def	2.2ef
24 hr Immersion Hortus 2500 ppm	1f	1g	0.0g
24 hr Immersion Hortus 5000 ppm	1f	1g	0.0g
24 hr Immersion Hortus 7500 ppm	1f	1g	0.0g
24 hr Immersion Hortus 10 000 ppm	1f	1g	0.0g

[y]Root quality (1-5, with 1=no roots and 5=healthy, vigorous root system).

[x]Cutting quality (1-5, with 1=dead and 5=transplant ready cutting).

[w]Growth index=(width1+width2+height)/3.

[v]Means followed by the same letter are similar and not significantly different ($\alpha = 0.05$).

Table 2. Influence of immersion duration on root percentage, number of roots, and average length of the three longest roots of Florida azalea.

Comparison	Rooting (%)	Roots (no.)	(Length of 3 longest roots)/3 (cm)
0 hr Immersion	30a[y]	1.3a	0.6a
1 hr Immersion	0b	0b	0b
6 hr Immersion	10b	0.3b	0.2ab
12 hr Immersion	10b	0.1b	0.2b
24 hr Immersion	0b	0b	0b

[y]Means followed by the same letter are similar and not significantly different ($\alpha = 0.05$).

DISCUSSION

Rooting percentages ranged to 0 to 30% depending on treatment with overall rooting percentages of 9%. In other studies, Florida azalea rooting ranged from 60% to 90% (Knight et al 2001, Knight et al. 2005, Thompson 2018). Difference between rooting results could partially be attributed to other studies using older, less soft cuttings compared to this study. IBA rates for this study were determined based on studies using harder cutting types, but it appears that lower rates may be more beneficial with softwood cuttings. Hortus recommends concentrations not exceeding 400 ppm IBA when using a basal long soak (Kroin 2016). Auxins, if applied in excess, can inhibit plant growth and ultimately cause plant death (Eliasson et al. 1989). Treatments using over 2500 ppm IBA or treatments submerged in higher concentrations for over one hour performed poorly in this study.

Based on the results found in this study, it would appear that young new plant tissue cuttings performed the best overall when subjected to Hortus at a rate of 2500 ppm IBA at a 0-hour immersion (five-second quick-dip).

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